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friendships with their former tutor. To accompany him on one of his daily walks was to realise a new pleasure in walking. It is perhaps worth recording, though a trivial matter, that he seldom failed to draw attention, when opportunity offered, to the transit-circle mark on Grantchester steeple, pointing out to his companion how it had been placed so as to minimise unsightliness.

When he gave up private tuition in 1888 his former pupils asked permission to have his portrait painted by Herkomer as a present for Mrs. Routh. Mr. Justice Stirling made the presentation in the company of a large number of the subscribers, including 13 senior wranglers.

Dr. Routh was elected a Fellow of the Royal Society in 1872, and served on its Council, 1888–90.

He was elected a Fellow of the Society on 1866 April 13.

H. H. T.

By the death of Mr. HENRY CHAMBERLAIN RUSSELL, C.M.G., B.A., F.R.S., the State of New South Wales has lost its former Government Astronomer and Meteorologist, and Australia one of its most eminent sons. Mr. Russell was the son of the Hon. Bourn Russell, and was born in West Maitland in 1836. He graduated at Sidney University in 1858, and obtained the Deas-Thomson Scholarship for Physics and Chemistry. Immediately on leaving the university he was appointed assistant to Mr. Scott, the Government Astronomer. At the age of 25 he temporarily held this latter post after the death of Mr. Scott, and before Mr. Smalley was appointed. On the death of the latter in 1870, Mr. Russell succeeded to the post and held it for thirty-five years. He at once set about re-organising and re-furnishing the observatory, so that within seven years he had added seven new rooms and a dome, and had replaced the old instruments by modern ones, and throughout his long tenure he kept the observatory in an efficient state. He also turned his attention to meteorology. In 1870 there were 12 meteorological observing stations in the whole State of New South Wales, and the Government could not afford any large contribution towards an increase. Mr. Russell, by his activity, persuasion, and influence, induced the squatters and farmers to make observations of rainfall and evaporation; and by his mechanical ingenuity furnished the stations with the necessary apparatus, with the smallest possible outlay. The result was that when he resigned his post in 1903 there were 1800 stations, and over 90 per cent. were voluntary.

Mr. Russell was chief organiser of the Australian observers of the transit of Venus in 1874. Five Australian observatories took part, and Mr. Russell furnished the report to the Royal Astronomical Society.

By 1876 he had collected all the observations of rainfall and discussed them, with the result that he believed there was a periodicity. In 1878 he had a large number of returns from the observing stations, and after careful analysis was enabled to com-

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mence the publication of weather maps in the papers. In 1887, in conjunction with Sir Charles Todd of South Australia and Mr. Ellery of Victoria, he succeeded in establishing a system of weather forecast, the weather changes occurring with an amount of regularity which permits of 82 per cent. of the forecasts being correct. Mr. Russell was greatly interested in the project of charting the heavens by means of photography, and attended the first meeting of the Congress in Paris. The zone -54° to -62°, requiring 1400 plates, was allotted him.

Such are the chief landmarks in two branches of scientific work, and they convey but a poor idea of Mr. Russell's genius and general activity. The picture may be filled in from the following general remarks.

Considering him as an inventor and mechanic, we find a list of 23 instruments designed and in great part made by him, generally with the object of ensuring success in his meteorological endeavours. We can mention only a few:—

A self-recording Anemometer and Pluviometer.

A self-recording Tide Gauge.

An electric Barograph.

Various self-recording Pluviometers.

An Anemometer in which the motion of the vane and cups is conveyed 75 feet vertically to the recording parts, and which also permits rain to drop 65 feet down the centre of a large tube and be recorded on the same sheet as the wind.

A Governor for driving clocks—the governor floating in mercury.

The application or combination of the two pendulums to produce uniform rotary motion.

An Equatorial Stand for the 11½-inch refractor.

The Equatorial mounting for the 15-inch reflector.

We find that he contributed 130 papers to various societies; and a general idea of the breadth of his interests may be gathered from a selection of his astronomical papers contributed to our Society. To the *Memoirs* he contributed—

"Report of the Transit of Venus," 1874, vol. xlvii. "Measures of Double Stars," in Sir J. Herschel's Cape Catalogue, together with a list of 351 new double stars, vol. xlvii. "Measures of Double Stars made at the Sydney Observatory in the years 1882–1889," vol. l.

And to the *Monthly Notices*—

"On the Australian Eclipse Expedition 1871," vol. xxxii. "Note on the Nebula surrounding η Argus," vol. xxxii. "Observations of Comet Brorsen," vol. xxix. "Observations of the Great Southern Comet of 1880," vol. xl. "Some Celestial Photographs taken at the Sydney Observatory." "An Electric Control for a Driving Clock," vol. li., "Transits of Mercury 1881 and 1894," vols. xlii., lv.

Mr. Russell took a very active part in initiating technical education, and served as a member of the Board of Technical Education, his services being recognised when in 1891 he was

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made Vice-Chancellor of the University of Sydney. He was for several years President of the Royal Society of New South Wales, and we may mention that he was the only graduate of Sydney ever elected to the Royal Society, of which he became a Fellow in 1886. In 1891 Mr. Russell was made Companion of the Order of St. Michael and St. George. In 1903 he had a severe illness, from which he was scarcely expected to recover, and ever since he had suffered from indifferent health; finally he succumbed, in his 71st year, on 1907 February 22. He leaves a widow, with one son and four daughters.

He was elected a Fellow of the Society 1871 February 10.

T. L.

Asaph Hall was born at Goshen, Connecticut, on the 15th of October 1829. At one time wealthy, the family had become poor, and Asaph Hall was apprenticed to a carpenter. Intending, however, to become an architect, he studied mathematics in his spare time. Finally, in 1856, he entered the University of Michigan and studied astronomy under Dr. Brünnow. Leaving Michigan, he became an assistant at Harvard Observatory, under Bond, where he remained until his transfer to the Naval Observatory at Washington in 1862. In the following year he was made Professor of Mathematics. He was amongst the earliest astronomers to appreciate the value of observations of Mars for determining the parallax of the Sun; his investigations, in 1862, of the solar parallax by this means is his first paper of note. From observations made at Upsala, Santiago, and Washington, he deduced the value of $8''.84$ for the solar parallax. In these early years at Washington he also published *A Catalogue of 151 Stars in the cluster of Præsepe*, and *A Study of Comets Faye and Winnecke*, showing that there was no retardation due to a resisting medium. In 1870 he published in the *American Journal of Science* an interesting paper on the "Secular Perturbations of the Planets." An important paper on the "Determination of Longitudes by Moon Culminations" appears in vol. xxxiii. of our *Monthly Notices*. About this time he was giving great attention to minor planets, both by observation and computation. Thus in the *Astronomische Nachrichten*, 1875, will be found a discussion of the Washington observations of Flora, and in the same publication for 1874 a determination of the orbit of Alceste. Throughout this period, too, he contributed numerous mathematical papers to the *American Journal of Science* and the *Messenger of Mathematics*.

In 1875 he took charge of the 26-inch Washington refractor, and made numerous measures of double-stars, diameters of planets, and distances and positions of satellites, which, with his drawings of Mars and Saturn, appear in the volumes of *Washington Observations*. Sir W. Herschel in 1794 found the rotation period of Saturn to be $10^{h}\ 16^{m}$, and from that time to 1876 no one appears to have made an attempt to verify this time. Professor Hall set this down as one of his tasks, and on December